

REMARKS

Reconsideration of this Application is respectfully requested. Applicants have addressed every objection and ground for rejection stated in the Office Action mailed September 30, 2003, Paper No. 8, and believe the Application is now in condition for allowance.

1. Statement of the Case and Status of the Claims.

The present invention provides a novel electrode active material, and batteries containing such a novel electrode active material. In a first instance, the electrode active material is represented by the general formula $A_aM_b(PO_4)_{3-x}(SiO_4)_xZ_d$, wherein,

- (a) A is selected from the group consisting of Li, Na, K, and mixtures thereof, and $0 < a \leq 8$;
- (b) M comprises one or more metals, wherein at least one of the one or more metals is capable of undergoing oxidation to a higher valence state, and $1 \leq b \leq 3$;
- (c) $0 < x < 3$; and
- (d) Z is selected from the group consisting of a hydroxyl, a halogen, and mixtures thereof, and $0 < d \leq 6$;

wherein A, M, Z, a, b, x and d are selected so as to maintain electroneutrality of the electrode active material.

In a second instance, the electrode active material is represented by the formula $A_aM_b(PO_4)_{3-x}(SiO_4)_xZ_d$, wherein,

- (a) A is selected from the group consisting of Li, Na, K, and mixtures thereof, and $0 < a \leq 8$;
- (b) M comprises two or more transition metals selected from Groups 4 through 11 of the Periodic Table, and $1 \leq b \leq 3$;
- (c) $0 \leq x \leq 3$; and
- (d) Z is selected from the group consisting of a hydroxyl, a halogen, and mixtures thereof, and $0 < d \leq 6$;

wherein A, M, Z, a, b, x and d are selected so as to maintain electroneutrality of the electrode active material.

In a third instance, the electrode active material is represented by the general formula $A_aM_b(PO_4)_{3-x}(SiO_4)_xZ_d$, wherein,

- (a) A is selected from the group consisting of Li, Na, K, and mixtures thereof, $0 < a \leq 8$;
- (b) M comprises $M'M''$, wherein M' is at least one transition metal selected from Groups 4 through 11 of the Periodic Table; and M'' is at least one element selected from Groups 2, 3, 12, 13, and 14 of the Periodic Table, and $1 \leq b \leq 3$;
- (c) $0 \leq x \leq 3$; and
- (d) Z is selected from the group consisting of a hydroxyl, a halogen, and mixtures thereof, and $0 < d \leq 6$;

wherein A, M, Z, a, b, x and d are selected so as to maintain electroneutrality of the electrode active material.

In a fourth instance, the electrode active material is represented by the general formula $A_aM_b(SiO_4)_{3-x}(PO_4)_xZ_d$, wherein,

- (a) A is selected from the group consisting of Li, Na, K, and mixtures thereof, $0 < a \leq 8$, and $a = 3 + 2x + d$;
- (b) M comprises one or more metals, wherein at least one of the one or more metals is capable of undergoing oxidation to a higher valence state, and $1 \leq b \leq 3$;
- (c) $0 \leq x \leq 3$; and
- (d) Z is selected from the group consisting of a hydroxyl, a halogen, and mixtures thereof, and $0 < d \leq 6$;

wherein A, M, Z, a, b, x and d are selected so as to maintain electroneutrality of the electrode active material.

Claims 120 - 180 are currently pending in the present Application. Upon entry of the present Amendment, Claims 120 - 180 will be cancelled and new Claims 181 - 329 will be added, and Claims 181 - 329 will be pending. Care has been taken to ensure that the new Claims contain no new matter.

2. Allowable Subject Matter

The Examiner stated in the Office Action that Claims 122, 127, 139 - 141, 151, 156, 158, 159 and 161 - 180 are objected to as being dependent upon a rejected base Claim, but would be allowable if rewritten in independent form, including all of the limitations of the base Claim and any intervening Claims. Applicants thank the Examiner for her consideration of these Claims, and for deeming the subject matter thereof allowable over the prior art of record.

In substantial accordance with the Examiner's suggestion, the subject matter of Claim 161 has been combined with independent Claim 149 to form new independent Claim 260. New Claims 261 - 286 depend, either directly or indirectly, from new independent Claim 260.

The subject matter of Claim 122 has been combined with the subject matter of independent Claim 120 to form new independent Claim 287. New Claims 288 - 306 depend, either directly or indirectly, from new independent Claim 287. New independent Claim 307 is directed to a battery containing the electrode active material of new independent Claim 287. New Claims 308 - 329 depend, either directly or indirectly, from new independent Claim 307.

Because new independent Claims 260 and 287/307 recite all of the limitations of Claims 161 and 122, respectively, including the limitations of the base Claims from which Claims 122 and 161 depend, Applicants submit that new Claims 260 - 329 are in condition for allowance.

3. Claim Rejections Under 35 U.S.C. §102

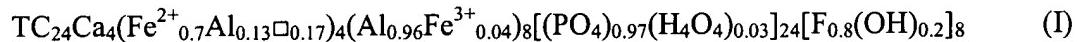
Claims 120, 121, 123 - 126, 128 - 131, 142 - 146, 149, 150, 152 - 155, 157 and 160 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,721,070 to Shackle ("Shackle '070"). Claims 120, 121, 123, 125, 126, 128, 129, 131 - 138, 142 and 144 - 148 stand rejected under 35 U.S.C. §102(b) as being anticipated by Rinaldi, "The Crystal Structure of Graphite, Complex Phosphate Not a Garnetoid" *Bulletin de Mineralogie*, 101(5-6), pp. 453-7 (1978) ("Rinaldi reference"). Claims 120, 121, 123 - 126, 128 - 131, 142 - 146, 149, 150, 152 - 155, 157 and 160 have been cancelled, and new Claims 181 - 259 have been added.

Shackle '070 discloses, among other things, an electrode material represented by the general formula $M_xT_yA_z$, wherein:

- (i) M is an alkali metal ion,
- (ii) T is a metal ion capable of existing in more than one stable oxidation state, and is selected from the group consisting of Mn, Fe, V, Ti, Co, Cu, Cr, Sn, Pb, W and Mo; and
- (iii) A is a multi-element anion with a negative charge greater than 1, and is selected from the group consisting of SiO_4 , TiO_4 , VO_4 , FeO_4 , MnO_4 and PO_4 .

Shackle '070 teaches that in some embodiments, the electrode material is “doped” by adding “other anions” (e.g. O^{2-} , S^{2-} , OH^{-1} , F^{-1} and Cl^{-1}). (See, Col. 4, ll. 34 - 67 of Shackle '070).

The Rinaldi reference discusses the results of a study of non-metamict graphite by X-ray diffraction. According to the Rinaldi reference, the structural formula of the subject graphite is represented by formula (I):



wherein:



The Examiner cites <http://webmineral.com/data/Graphite.shtml> (“webmineral webpage”), which discloses that graphite has a isometric - diploidal crystal structure (Space Group Pa3) and is represented by the chemical formula $Ca(Mn,Na,Li)_6Fe^{++}Al_2(PO_4)_6(F,OH)_2$. Applicants respectfully note that it is not clear from the contents of the webmineral webpage when the effective prior art date of the webpage first occurred. Therefore, Applicants respectfully submit that the webmineral webpage should not be considered prior art against the present Application.

However, the prior art of record fails to teach or suggest an electrode active material represented by the general formula $A_aM_b(PO_4)_{3-x}(SiO_4)_xZ_d$, wherein either $0 < x < 3$ or M comprises two or more transition metals selected from Groups 4 through 11 of the Periodic Table.

In contrast, new independent Claims 181 and 201 recite, among other things, an electrode active material represented by the general formula $A_aM_b(PO_4)_{3-x}(SiO_4)_xZ_d$, wherein $0 < x < 3$. Furthermore, new independent Claims 224 and 240 recite, among other things, an electrode active material represented by the general formula $A_aM_b(PO_4)_{3-x}(SiO_4)_xZ_d$, wherein M comprises two or more transition metals selected from Groups 4 through 11 of the Periodic Table.

Accordingly, because the prior art of record fails to teach or suggest Applicants invention as recited in new independent Claims 181, 201, 224 and 240, Applicants respectfully submit that these new Claims, and all Claims depending there from, are patentably distinct prior the prior art of record. Accordingly, Applicants respectfully submit that new Claims 181 - 259 are in condition for allowance.

4. **Conclusion.**

In view of the remarks presented herein, Applicants submit that every objection and grounds for rejection stated in the Office Action mailed September 30, 2003, Paper No. 8, have been overcome. Accordingly, Applicants respectfully request allowance of all Claims presented herein. Should anything further be required, the Examiner is respectfully requested to telephone the undersigned at 702-558-1071.

Respectfully submitted,

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